REMARKS

Favorable reconsideration of the application is respectfully requested in light of the amendments and the following detailed discussion. In the amendment, claims 44 and 55-57 have been cancelled and claims 42-46 have been amended. It is respectfully submitted that no new matter has been introduced by these amendments. An extension of time request, for a three month extension for responding to this office action, along with a check for a three month extension of time fee, accompanies this amendment.

Claim 44 was rejected by the Examiner under 35 USC §112, first paragraph as containing new matter. Specifically, the Examiner rejected the inclusion of the term titanium tetraalkoxide as not being in the originally filed specification and claims. In response thereto, claim 44 has been cancelled herein. It is respectfully submitted that this rejection is therefore moot.

The Examiner acknowledges applicants assertion that Greenberg is not a proper reference under 35 USC §102(a) and has now instead rejected the claims over Greenberg under 35 USC §103.

Claims 42, 43, 45 and 55-58 are rejected under 35 U.S.C. §103 as being unpatentable over Greenberg et al (U.S. Patent No. 6,027,776 ("Greenberg")). The Examiner opined that the features of applicant's claims could be found in the abstract, drawings, col. 3, lines 32-66, col. 4, lines 30-63, col. 5, lines 18-46, col. 7, lines 1-11, the examples and the claims.

Claim 44 stands rejected under 25 USC §103(a) as being unpatentable over Greenberg in view of US 6,110,528 to Kimura et al. Claim 44 has been cancelled herein, rendering the rejection thereagainst moot.

Claims 46-54 stand rejected under 35 §103(a) as being unpatentable over Greenberg in view of WO 98/06675 to Sheel et al. The Examiner notes that it would have been obvious to one skilled in the art to use the precursors of Sheel in the CVD method of Greenberg, because Sheel taught that precursors enabled high conversion efficiency with low cost metal conversion compounds.

Applicants respectfully submit that the amended claims are patentable over the disclosure of Greenberg. The invention, as defined in amended claim 42, is a process for the production of a durable photocatalytically active coated glass in which the titania layer has a thickness of less than 30 nm and the substrate is at a temperature in the range 625°C to 720°C during the deposition of the coating. The coating also has a photoactivity of greater than $5 \times 10^{-3} cm^{-1} min^{-1}$. Additionally, amended claim 42 requires that the titanium oxide coating is deposited on a glass ribbon formed during float glass production process. Claim 42 now incorporates subject matter from claims 55 and 56. It is respectfully submitted that support for the amendments to claim 42 regarding a thickness of 30 nm or less can be found on page 6, line 4 of the application as filed.

Applicants continue to assert that claim 42 is inventive over the prior art and specifically over Greenberg in that it defines a process for the production of a photocatalytically active coated glass which is carried out within a specific narrow temperature range (625°C to 720°C) and using conditions so as to provide a relatively thin film having a thickness of less than 30 nm and a photoactivity of greater than $5 \times 10^{-3} cm^{-1} min^{-1}$. Such coatings have been discovered to be durable, to be sufficiently photoactive and to exhibit lower visible light reflection than previously known coatings. There is nothing in Greenberg or in the secondary references Kimura or Sheel to indicate the use of these particular process conditions.

The claim, as amended, requires that the photoactive titanium oxide layer is both thin (30 nm thick or less) and significantly photoactive (activity greater than 5 x $10^{-3}cm^{-1}min^{-1}$ measured using the technique described on page 10 of the application). The titanium oxide layer is deposited onto the surface of a glass ribbon formed during a float glass production process and is deposited by contacting a gaseous mixture with the ribbon at the specified temperature.

It is respectfully submitted that the claimed process, using a gaseous mixture (a CVD process) distinguishes the claimed process from the spray pyrolysis process which are disclosed by Greenberg. Claim 42 is directed to processes for the production of coatings which provide a high level of photoactivity from a thin coating which thereby has a low reflection. The coated products represent a significant advance in the art because this combination of high activity and low reflection makes the glass suitable for use as a window. As is discussed below Greenberg nowhere suggests that such coated glasses could be produced and furthermore nowhere suggests that they could be produced using a CVD process in the float bath. While Greenberg discloses both CVD processes (specifically in Examples 1 to 3) and spray pyrolysis processes (specifically Examples 4 and 5), the above amendments distinguish over the spray pyrolysis processes shown in Greenberg.

Applicants concur that Greenberg does disclose CVD processes for the deposition of a photocatalytically active titanium oxide coating which may be carried out as part of a float glass production process. Greenberg identifies useful titanium precursors at column 4 line 51. Greenberg teaches that the processes may be carried at a broad temperature range from 400 to 800° C.

Generally, Greenberg teaches that the titania coating may be from 100Å to 2500Å thick. Greenberg specifies that "for a wide variety of applications it is preferred that the PASC coating

is at least 200Å thick, preferably at least 400Å thick and *most preferably at least 500Å thick*" (column 3 line 66). Further, Greenberg states that the coating must be *sufficiently thick to provide an acceptable level of activity* (column 3 line 46). Greenberg states (column 12 line 56) that for most applications a PASC activity of at least about 2×10^{-3} and preferably at least about 5×10^{-3} cm^{-1} min^{-1} is desired. Greenberg specifically discloses PASC coatings formed by a CVD process having a thickness of 2100Å (Example 1) and 700 - 800Å (Example 2). Greenberg concludes (column 15 line 47) that thicker PASC coatings (i.e. thicker than 700Å) maintain higher PASC activity. In this regard, it is significant to note that the coating of example 2 has an activity of 0.17×10^{-3} cm^{-1} min^{-1}. This thickness is *less* than Greenberg has indicated is preferable and *significantly less* than is now required in the applicants amended claim.

With regard to coatings produced by CVD, Greenberg teaches that CVD processes may be used to produce coatings which have a useful level of photoactivity but which are *relatively thick.* The discussion of the thickness of the coating is significant in relation to coated glass because it is known that the thickness is proportionate to the reflection of the coating. Greenberg himself points out (column 3 line 57) that for certain applications requiring high transmission a *thinner coating may be preferred.* Thus, Greenberg teaches that for applications requiring high light transmission (i.e. low light reflection) his processes require a compromise between transmission and activity. For low reflection the photoactivity will be less than what is regarded as "acceptable" in the reference. As can be seen from the attached graph (Attachment A) measuring the reflection of coatings produced by the Applicants claimed process; titania coatings having a thickness of 40 nm (400Å) exhibit a reflection of over 35% on the coated side

The Examiner continues to opine that it would be obvious to use the claimed temperature range and produce the claimed thickness range because the specific process conditions are not

critical but merely optimal. It is respectfully submitted that this argument involves a hindsight analysis of the invention. Greenberg, as clearly shown above, teaches away from the idea that high activity/low reflection coatings can be produced and in particular that they can be produced using a CVD process. Greenberg clearly states that thicker coatings provide higher PASC activity. Examples 1,2 and 3 produce a coated glass using a CVD process but only the product of Example 1 which is 2100Å (210 nm) thick provides a level of activity which he the reference itself indicates as preferable, and even then is **below the activity required in the Applicants amended claim**. Greenberg nowhere suggests that his processes could be "optimized" to produce a low reflection/high activity product. This is a telling omission. Greenberg is clearly aware that such products are desirable but he nowhere indicates how they might be obtained. The Examples which form part of this application demonstrate clearly that the Applicants have discovered CVD processes which do produce a low reflection/high activity product. It is submitted that the claims as now amended define an invention which is both novel and inventive.

As stated previously, with regard to the temperature limitation, Greenberg's disclosure embraces a wide range from 400° C (column 5 line 46) to 800° C (column 5 line 43). The Examiner points, in particular, to Table 6 and Example H as anticipating the present claims. The claims of this application are novel over this specific disclosure in so far as they require the titania layer to have a thickness of less than 30 nm. It is also worthy of note that Table 6 reports the results of a spray pyrolysis using titanium acetylacetonate as the titanium source.

Further, Example H of Table 6, which the Examiner cites in refuting the earlier presented arguments, indicates a titania thickness of 400 Å. The present claim 42 requires a thickness of **less than** 30nm (300Å.) Applicants assert that the Examiners' reference to this Example is improper, as the thickness cited is outside the range claimed by claim 42. In fact, all of the

examples cited in Table 6 disclose titania thicknesses of at least 400Å. Thus, none of the Examples of Table 6 can be said to render claim 42 obvious. It is thus submitted that the Examples of Table 6 are not the proper basis for an anticipation rejection of the present claims.

As submitted previously, the claims are inventive over Greenberg because it is surprising that such relatively thin layers are photocatalytically active. The result is a coated glass substrate with a lower reflection. The production of a thinner layer provides process advantages in that less raw material is required and in so far as thinner coatings are easier to deposit. Note that in discussion of Table 6, Greenberg urges that a 625Å titania layer deposited directly on the glass has the same activity as a 400Å titania layer deposited on top of a barrier layer. The only references in Greenberg to thinner titania layers are in combination with the barrier layers. Greenberg is thus clearly teaching that thicker layers are preferred as opposed to the thin layers as depicted in the claims of the present invention. It is important to note that the disclosure of Greenberg's corresponding WO 98/41480 says that the coating is at least 400 Å thick and preferably at least 500 Å thick (with the Abstract of this WO reference indicating it must be at least 500 Å thick.) As this rejection is now based on 35 USC §103, it is important to note, as discussed at length above, that Greenberg teaches significantly away from the particular feature set described in claim 42.

There is nothing in the Greenberg reference that would lead one skilled in the art to the conclusion that layers of a thickness of 30nm or less would be acceptably photocatalytic. These surprising results are further proof that the thickness range (especially in conjunction with the temperature range) defined in claim 42 is not anticipated, nor rendered obvious, by the disclosure of Greenberg.

Again, to reiterate, the applicants' invention lies in their discovery that a durable photocatalytic **thin (< 30 nm)** coating can be produced using a temperature in the range 645°C to 720°C. This coating is surprisingly sufficiently photocatalytic to serve the intended purpose, and also has additional significant advantages as defined above. Greenberg does not anticipate this thickness and, in fact, teaches away from it.

In view of the above, it is respectfully submitted that claim 42 distinguishes over the applied art of record.

The Kimura reference was specifically cited against claim 44 which has been cancelled herein. Therefore, the Kimura reference is moot regarding the remaining rejections.

Independent claim 47 was rejected under Greenberg in view of Sheel. Applicants acknowledge that Sheel discloses a CVD depsoition process which uses titanium tetrachloride and ethyl acetate as the reactants. However, it is respectfully submitted that Sheel nowhere suggests that the coatings described therein are photoactive. It is respectfully submitted that it is not obvious that the process of Sheel could be used to produce photoactive coatings and in particular low reflection/high activity coatings. Further, applicants' claims require that the deposition process is carried out at a higher temperature that is taught by Greenberg. It is therefore submitted that it is improper to combine the Greenberg and Sheel references. It is thus believed that claim 47 is distinguishable over the applied art of record.

The above arguments regarding thickness also apply to the rejection of claim 47 and claims dependent thereon. Claim 47 defines a process for the production of a photocatalytically active coated substrate. The process comprises depositing a titanium oxide coating having a thickness of less than 40 nm on a substrate. The deposition is done by contacting a surface of the

substrate with a fluid mixture comprising titanium chloride and an ester other than a methyl ester.

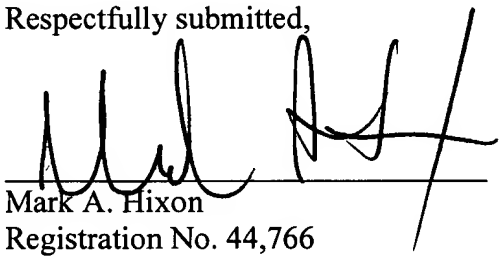
However, even if the Sheel reference were to be combined with the Greenberg reference, it would not overcome the deficiencies therein. Claim 47, as does claim 42, requires a thickness of less than 40 nm. Therefore, nothing in Greenberg anticipates, nor renders obvious the thickness as claimed in claim 47 for all of the reasons discussed hereinabove, with respect to claim 42. For these reasons, claim 47 is patentable over Greenberg alone or in combination with Sheel.

The remaining claims are believed to be allowable based, at least, upon their dependence, directly or indirectly, from what are believed to be allowable base claims.

For all of these reasons, applicants respectfully submit that the instant amendment places the application in condition for allowance. Accordingly, it is courteously requested that the application be passed to issue.

In the event the Examiner would prefer language other than that set forth in the claims, it is requested that a telephone interview be had to assist in expediting the prosecution of the application.

Respectfully submitted,



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